Geophysical Research Abstracts
Vol. 16, EGU2014-10075-2, 2014
EGU General Assembly 2014

Multiple reactivation of a crustal-scale weakness zone - the Sveconorwegian Sokna-Saggrenda tectonic contact of southern Norway

Thomas Scheiber (1), Giulio Viola (1,2), Max Peters (3), Bernard Bingen (1), and Iain Henderson (1)

(1) Geological Survey of Norway, Trondheim, Norway (thomas.scheiber@ngu.no), (2) Department of Geology and Mineral Resources, Norwegian University of Science and Technology, Trondheim, Norway, (3) Institute of Geological Sciences, University of Bern, Switzerland

The Sokna-Saggrenda tectonic contact (SSTC) is traditionally drawn on maps of southern Norway as the first-order, curved boundary between the Kongsberg-Modum terrane in the east and the Telemark terrane in the west, which were assembled during the Grenvillian-Sveconorwegian orogeny. New field observations along the entire length (120 km) of this deformation zone together with microstructural and textural data from selected transects suggest a more complex structural architecture and evolution than previously assumed.
The following five structural elements resulting from several deformation episodes can be distinguished: (1) Amphibolite-facies mineral assemblages occurring together with a prominent E-dipping ductile foliation and a mineral lineation plunging moderately towards the NE. This fabric is associated with top-to-the-SW kinematics and is well preserved west of the SSTC. (2) Static overprint of the dynamically recrystallized quartz microstructure of (1) indicates cessation of deformation at relatively high temperatures. (3) (Ultra-)mylonites thoroughly overprinting the previous structures are confined to large-scale subvertical to moderately E-dipping shear zones bearing a gently SE-plunging stretching lineation. At the micro-scale, these structures are characterized by domains of older statically recrystallized quartz (2), being progressively reworked through dynamic recrystallization into quartz-rich aggregates. In the shear zone centers severe grain size reduction by mechanical comminution and phase mixing indicates granular flow. At the map-scale, the shear zones are arranged geometrically in a sinistral transpressional en-échelon network defining parts of the SSTC. Three crustal blocks can be identified as less-affected units in between these shear zones: the Telemark block, a western Kongsberg block and an eastern Modum block. A tens of kilometer-scale fold structure reorients the main ductile fabric (1) in the northern part of the Modum block and is probably related to this sinistral shearing. (4) Top-to-the-ESE ductile to brittle-ductile extensional structures locally reactivating the SSTC in response to the late Sveconorwegian orogenic collapse. (5) A later brittle fault zone, representing the SSTC as shown on geological maps. This brittle fault zone (itself resulting from several episodes of faulting in the brittle regime) selectively reactivated the older major ductile shear belt(s).
The presence within the brittle SSTC of lenses of fault rocks ascribable to all of the structural elements listed above confirms that the SSTC is a zone of crustal-scale weakness, repeatedly active under different conditions. New zircon U-Pb data show that the SSTC developed mainly at the expense of a ca. 1170 Ma old granitic belt, possibly already deformed in a brittle fashion. This belt was probably pivotal in localizing viscous strain during the development of the early ductile SSTC, along which the Kongsberg block was thrust southwestwards over the Telemark block. Sinistral shearing and repeated phases of brittle faulting followed and continued down to at least the Cretaceous.
These results bear major implications for the regional geology and shed light onto the relationship between the Kongsberg, Telemark and Modum blocks by challenging the classical model of a “simple” W-directed terrane accretion during the Sveconorwegian orogeny.